specific process conditions such as sensed melt temperature." Moreover, the application states that the control unit 51 "uses a reduced set of control parameters including two basic response constants that are a function of crystal length (*e.g.*, a height response coefficient A_h and a power response coefficient A_p)," and that "the control unit 51 deduces the parameters A_h and A_p from a single control run using the series of power pulses or from a ***global simulation of the temperature field*** in puller 13 for several values of the meniscus height and power. (See application page 13, lines 21-27). In this regard, Applicants direct the Examiner's attention to equations 1 - 5 and the accompanying description as set forth in the application. (See application pages 14-17). In particular, equation 4 and equation 5 define the height response coefficient A_h and the power response coefficient A_p, respectively, in terms independent of a sensed temperature. As can be seen from equations 1 - 5, control parameter A_h and A_p are derived independently of a sensed temperature. Thus, there is teaching in the specification that the control loops are to act independently of the temperature, and the Examiner is respectfully requested to withdraw the rejection of claims 1 and 21 for containing subject matter that was not described in the specification.

Claims 1- 21 also stand rejected under 35 U.S.C. 103(a) as being unpatentable over Cope, U.S. Patent No. 3,761,692 in view of Araki, EPO 0 499 220 A1. The Examiner asserts that "the sole difference between instant claims and the [Cope patent] is the intervals," and that "it would have been obvious to one of ordinary skill in the art to modify the Cope process by the teachings of the Araki reference to take diameter measurements at set intervals. . . ." (Office action at page 3). However, the references cited by the Examiner merely disclose conventional methods for controlling silicon crystal growth and fail to teach the invention. In other words, the cited art requires both melt temperature sensing means and diameter sensing means in direct contradiction to claim 1. Thus, the Cope and Araki references fail to teach or suggest each and every aspect of the invention as claimed in the present application.

The present invention advantageously controls silicon crystal growth to minimize growth rate and diameter variations ***independent of a temperature sensed during processing***. (See application, page 13, lines 11-13). To this end, claim 1 recites, in part, "determining a pull rate parameter as a function of the estimated steady-state growth rate V_{gs}," "determining a heater power parameter as a function of the estimated steady-state growth rate V_{gs}," "***said pull rate parameter and heater power parameter being determined independently of a temperature condition sensed during processing***, " and "adjusting the pull rate V_p according to the pull rate parameter and adjusting the power supplied to the heater by the power supply according to the heater power parameter."

In contrast, the cited art merely discloses a conventional method for controlling silicon crystal growth that ***requires both a melt temperature sensing means and a diameter sensing means***. (See Cope, Abstract). In conventional growth processes, the pull rate V_p is a known parameter since it is set by the seed lift recipe. The seed lift recipe also includes a unique height (denoted by h_s) for growing a cylindrical ingot of a fixed diameter and any deviation of the meniscus height h from h_s results in a diameter change. In other words, an evolution in diameter occurs because of an error in the meniscus height as a function of time, *i.e.*, h(t). (See Application, page 14). Applicants have defined relationships between melt temperature gradient and meniscus height, meniscus height and diameter, diameter and growth rate, and growth rate and heater power to ***control both pull rate and temperature based on no more than crystal diameter or radius measurements taken over the observation interval.*** (See Application, pages 14-17).

Moreover, a prior art reference must be considered in its entirety, including those portions that would lead away from the invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540 (Fed. Cir. 1983). In this instance, the Cope reference discloses that "[t]he temperature control algorithm receives a filtered input signal from

the melt temperature sensor which senses the temperature of the molten silicon," and that a "[d]iameter sensor applies a signal through [a] digital filter to the diameter control algorithm." (Cope, column 4, lines 56-60 and column 5, lines 1-5). As explained above, rather than controlling silicon crystal growth as a function of a sensed temperature, Applicants disclose ***controlling both pull rate and temperature based on no more than crystal diameter or radius measurements taken over the observation interval.*** A system that discloses determining a crystal pull rate as a function of a sensed temperature during processing inherently teaches away from a system that discloses determining the crystal pull rate independently of a sensed temperature. As a result, Applicants invention is much easier to tune. Accordingly, Applicants submit that the Examiner has failed to consider the Cope reference in its entirety and has ignored those portions that would lead away from the invention.

In view of the foregoing, Applicants submit that claims 1-21 are in condition for allowance and respectfully request favorable reconsideration of this application.

Applicants have reviewed the cited but unapplied art and find it to be no more pertinent than the art discussed above.

The Commissioner is hereby authorized to charge any fees that may be required during the entire pendency of this application to Deposit Account No. 19-1345.

Respectfully submitted,

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